

Department of Computer Engineering

Academic Term: First Term 2023-24

Class: T.E /Computer Sem - V / Software Engineering

Practical No:	5
Title:	Estimating project cost using COCOMO Model
"Date of Performance:	16/08/23
"Roll no:	9542
Team Members	

Rubrics for Evaluation:

Sr. No	Performance Indicator	Excellent	Good	Below Average	Total Score
1	On time Completion & Submission (01)	01 (On Time)	NA	00 (Not on Time)	
2	Theory Understanding^)	02(Correct)	NA	01 (Tried)	
3	Content Quality (03)	03(All used)	02 (Partial)	01 (rarely followed)	
4	Post Lab Questions (04)	04(done well)	3 (Partially Correct)	2(submitted)	

Signature of the Teacher

a) Basic cocomo model

Kloc (lines of code > 8 -KILO LINES OF CODE

-this includes our own code as well that of imported libraries, bootstrap components and modules including navbars ,pages and other models

Factors a and b for basic COCOMO model organic mode are as follows

a=2.4,

b=E05

According to basic COCOMO equation $E_{nom} = a(KLOC)^b * EAF$ - person months

$$= 2.4 * 8 * 1.05$$

$$= 20.16$$

b) COCOMO Intermediate model (SEMI -DETACHED MODE)

The formula for the COCOMO Intermediate Model in semi-detached mode is:

$$E = a * (KLOC)^b * EAF$$

The COCOMO Intermediate Model (also known as the COCOMO II model) is a software cost estimation model that takes into account 15 project attributes, or cost drivers, to produce more accurate estimates than the Basic COCOMO model. The semi-detached mode of the COCOMO Intermediate Model is used for projects that are neither as well-understood as organic projects nor as complex as embedded projects.

The formula for the COCOMO Intermediate Model in semi-detached mode is:

$$E = a * (KLOC)^b * EAF$$

where

- E is the effort in person-months
- KLOC is the estimated number of thousands of delivered lines of code
- a and b are constants that are determined by the project's environment and technology
- EAF is the effort adjustment factor, which is a product of 15 cost drivers

The cost drivers for the semi-detached mode of the COCOMO Intermediate Model are

I) The values for the constants a and b in the COCOMO Intermediate Model are different for each mode. For the semi-detached mode, the values are:

- a = 2.4
- b = 1.05

Cost Driver	Description	Rating	Multiplier
MODP	Modern programming practices	Very High	1.24
TOOL	Software Tools	High	1.24
SCED	Development Schedule	Very High	1.23
TIME	Execution time constraint	High	1.11
STOR	Main storage constraint	Nominal	1.21
VIRT	Virtual machine constraint	Nominal	1.15
TURN	Computer turnaround time	High	1.07
LEXP	Language experience	High	1.14
ACAP	Analyst capability	High	1.12

AEXP	Applications experience	High	1.29
PC A D)	Programmer capability	Extremely High	1.42
VEXP	Virtual machine experience	Nominal	1.21
RELY	Required software reliability	Extremely High	1.24
DATA	Database size	Extremely High	1.36
CPLX	Product complexity	High	1.12

2. Calculate the effort adjustment factor (EAF) by multiplying the ratings of all of the cost drivers.

$$\text{EAF} = 1.24 * 1.24 * 1.23 * 1.11 * 1.21 * 1.07 * 1.14 * 1.12 * 1.29 * 1.42 * 1.21 * 1.24 * 1.36 * 1.12 = 2.58$$

3. Use the EAF to calculate the estimated effort for the project.

The estimated effort for the project is:

$$E = a * (\text{KLOC})^b * \text{EAF}$$

where

- E is the estimated effort in person-months
- KLOC is the estimated number of thousands of delivered lines of code
- a and b are constants that are determined by the project's environment and technology
- EAF is the effort adjustment factor

In this case, the constants a and b are:

- a = 2.4
- b = 1.05

Therefore, the estimated effort for the project is:

$$E = 2.4 * (KLOC)^{1.05} * 2.58$$

the project will have a 1850 lines of code, then the estimated effort is:

$$E = 2.4 * (1850)^{1.05} * 2.58 = 22.7 \text{ person-months}$$

This means that the project is expected to take 22.5 person-months to complete.

The team has 3 members, then each member will have to contribute 7.6 person-months to the project.

$$22.7 \text{ person-months} / 3 \text{ team members} = 7.6 \text{ person-months/team member}$$

MODP: Modern programming practices. This is rated as very high because the system will be developed using modern programming practices such as object-oriented programming using javascript, other frameworks and agile development. These practices can help to improve the quality and maintainability of the software, but they can also make the development process more complex and time-consuming. TOOL: Software tools. This is rated as high because the system will use a variety of software tools to help with the development process, such as a code editor, debugger, and testing framework. Also the system will make use of external services such as firebase for hosting and user management. These tools can help to improve the productivity of the developers, but they can also be expensive.

SCHED: Development schedule. This is rated as high because the system is needed to be completed in a short period of time. This can make it difficult to deliver a high-quality product.

TIME: Execution time constraint. This is rated as medium because the system does not have any strict performance requirements. However, it is still important to make

sure that the system is responsive and does not take too long to load and works as needed.

- STOR: Main storage constraint. This is rated as low because the system does not require a large amount of main memory.
- VIRT: Virtual machine constraint. This is rated as low because the system will be running on a standard virtual machine.
- TURN: Computer turnaround time. This is rated as medium because the system will need to be able to handle a reasonable number of concurrent users. However, it is not expected to be a major bottleneck.
- LEXP: Language experience. This is rated as high because the developers will need to have experience with the programming language that will be used for the project. This can help to improve the productivity of the developers and reduce the risk of errors.
- ACAP: Analyst capability. This is rated as high because the analysts will need to have experience in understanding and specifying software requirements. This can help to avoid problems later in the development process.
- AEXP: Applications experience. This is rated as high because the developers will need to have experience in developing similar types of software. This can help to improve the productivity of the developers and reduce the risk of errors.
- PC'AP: Programmer capability. This is rated as high because the developers will need to be highly skilled and experienced. This can help to ensure that the software is of high quality and meets the requirements.
- VEXP: Virtual machine experience. This is rated as low because the developers do not need to have any experience with the virtual machine that will be used for the project. However, this is not a major concern because the virtual machine is a standard one and there are plenty of resources available to help the developers learn how to use it.
- RELY: Required software reliability. This is rated as high because the system is a critical application and it is important to ensure that it is reliable for all the users accessing the placement portal and the admin managing access to it.
- DATA: Database size. This is rated as medium because the system will not need to store a large amount of data. However, it will still be important to design the database carefully to ensure that it is efficient and scalable.
- CPLX: Product complexity. This is rated as high because the system is a complex application with a lot of different interfaces for different users. This can make the development process more challenging, but it can also lead to a more robust and reliable system.

postlabs-

a) Analyse the COCOMO model and its different modes (Organic, Semi-detached, Embedded) to determine the most suitable mode for a specific project type.

The COCOMO model is a software cost estimation model that is used to estimate the effort, development time, and staff size required to develop a software project. The model takes into account the size of the project, the complexity of the project, and the experience of the development team.

The COCOMO model has three modes:

- Organic mode: This mode is used for small, simple projects with a small development team. The development team is typically inexperienced and the requirements are not well-defined.

The most suitable mode for a specific project type will depend on the size, complexity, and experience of the development team.

Semi-detached mode: This mode is used for medium-sized projects with a moderate level of complexity. The development team is typically experienced and the requirements are well-defined.

Embedded mode: This mode is used for large, complex projects with a large development team. The development team is typically very experienced and the requirements are highly complex.

b) Apply the COCOMO model to estimate the project cost and effort required for a given software development project.

The COCOMO model can be used to estimate the project cost and effort by following these steps:

1. Estimate the size of the project in terms of function points or lines of code.
2. Determine the mode of the project.
3. Estimate the effort adjustment factor (EAF) based on the factors that influence the project, such as the reliability of the requirements, the use of software tools, the experience of the development team, and the schedule constraints.
4. Calculate the estimated effort using the following formula:

$$E = a * KLOC^b * EAF$$

where

- E is the estimated effort in person-months
 - KLOC is the estimated number of thousands of lines of code
 - a and b are coefficients that are specific to the mode of the project
 - EAF is the effort adjustment factor
5. Calculate the estimated development time using the following formula:

$$D = T * E$$

where

- D is the estimated development time in months
 - T is the average productivity of the development team in person-months per month
6. Calculate the estimated cost of the project using the following formula:

$$C = E * R$$

where:

- C is the estimated cost of the project in dollars
- R is the average hourly rate of the development team in dollars per hour

c) Evaluate the factors influencing COCOMO estimates, such as project size, personnel capabilities, and

development tools, and their implications on project planning and scheduling.

The factors that influence COCOMO.0 estimates include:

- Project size: The larger the project, the more effort and time it will take to develop.
- Personnel capabilities: The more experienced the development team, the less effort and time it will take to develop the project.
- Development tools: The use of software tools can help to improve productivity and reduce the amount of effort required to develop the project.

The implications of these factors on project planning and scheduling include:

- The project manager needs to carefully consider the size, complexity, and experience of the development team when planning the project.
- The project manager needs to ensure that the development team has the necessary skills and experience to use the development tools that are being used.
- The project manager needs to make sure that the project schedule is realistic and takes into account the factors that influence COCOMO estimates.